Further Explanation of the Dynamic Market Rule

Gregory Rosston and Andrzej Skrzypacz
Prepared for T-Mobile
September 2013

EXECUTIVE SUMMARY

The Dynamic Market Rule ("DMR")[1] offers a mechanism for the Commission to put the potential revenue concerns of a spectrum-aggregation limit to a market test. Employing the DMR or a similar mechanism in the auction design can increase auction revenue. Using AT&T's example with a small change demonstrates how the DMR could increase auction revenue relative to an auction with no spectrum-aggregation limit. Moreover, the prospect for gradual relaxation of the limits provides a failsafe against limits causing auction revenue failing to meet whatever minimum threshold the Commission should adopt.

AT&T's apparent concern regarding the exposure risk is similarly misplaced. First, AT&T's exposure risk concerns are at odds with its revenue argument – if the DMR were likely to cause revenues to fall short of the target, then AT&T could expect the spectrum-aggregation limits to be relaxed and it would not face an exposure risk. Second, AT&T's exposure-risk concerns are not specific to the DMR, but are inherent in the organization of the incentive auction framework. Third, even if the exposure risk AT&T identifies were specific to the DMR, reducing exposure risk for AT&T would likely result in a concomitant *increase* in exposure risk for smaller bidders: the net risk bidders experience is not necessarily less in the absence of the DMR, but the effects fall more heavily on smaller carriers.

We propose a mechanism to seamlessly integrate the DMR supplemental rounds with the Commission's proposed extended rounds. This integration allows the Commission to combine the DMR's benefits with the features of the extended rounds to further increase the likelihood that the auction will meet its clearing target.

In sum, should the Commission find that the consumer benefits of robust wireless competition warrant adoption of a spectrum-aggregation limit, the DMR offers a mechanism to enhance competition while providing substantial assurances that the limits will be enforced only as long as revenues meet or exceed the revenue target.

[1] Gregory Rosston and Andrzej Skrzypacz, A Dynamic Market Rule for the Broadcast Incentive Auction: Ensuring Spectrum Limits Do Not Reduce Spectrum, attached to *Ex Parte* Notice of T-Mobile USA, Inc., WT Docket No. 12-268 (July 26, 2013) ("T-Mobile Proposal").

Introduction

We have prepared this filing in response to questions about the mechanics of T-Mobile's proposed DMR regarding revenue, exposure risk, and integration of the DMR and the extended rounds suggested by Milgrom, Ausubel, Levin, and Segal in the second of two papers ("MALS2").[2] We show that the DMR could lead to increased revenue and hence increased spectrum clearing relative to an auction with no spectrum-aggregation limits. We also show the concerns regarding the exposure risks from the DMR are not specific to the DMR. We explain how spectrum-aggregation limits would decrease the exposure risks for smaller bidders. Finally, we lay out a step-by-step mechanism that incorporates the revenue enhancements of both the extended rounds set forth by the MALS2 proposal and the additional competition of the DMR.

AT&T's Criticisms of the DMR

AT&T has prepared an analysis that raises potential issues of concern to AT&T with T-Mobile's proposed DMR.[3] AT&T's main criticisms are in two areas: revenues and exposure risk.[4] While we believe the most important consideration for the Commission should be public interest benefits for consumers, we focus solely on the two areas of the auction mechanics AT&T identifies because other submissions have addressed the competition policy issues relating to spectrum concentration.[5]

---

[2] *See* Paul Milgrom, Lawrence Ausubel, Jon Levin, & Ilya Segal, "Auctionomics/Power Auctions Option for Forward Auction," WT Docket No. 12-268, at 6 (filed Feb. 1, 2013), *available at* http://apps.fcc.gov/ecfs/document/view?id=7022116356.

[3] Yeon-Koo Che and Philip A. Haile, "Comments on T-Mobile's 'Dynamic Market Rule' Proposal," attached to *Ex Parte* Presentation of AT&T Inc., WT Docket No. 12-268 (Aug. 13, 2013) ("AT&T Comments"). Verizon has filed an ex parte notice of its discussion with the FCC regarding many of the same issues. *See Ex Parte* Notice of Verizon Communications, GN Docket No. 12-268, August 29, 2013. In addition, Verizon submitted a paper by Leslie Marx, "Economic Analysis of Proposals that would Restrict Participation in the Incentive Auction," attached to Letter from Tamara Priess, Verizon, to Ruth Milkman, Chief, Wireless Telecommunications Bureau, Federal Communications Commission, GN Docket No. 12-268 (Sept. 18, 2013). The discussion herein focuses on the AT&T analysis but applies to Verizon's similar points as well.

[4] *See* AT&T Comments at 4-5. We note that auction revenues may be an efficient way to fund government expenditures, but also note that every dollar of revenue will be partially offset by reduced revenue later as the cost of spectrum will be deducted from income tax due as the costs of the licenses are amortized.

[5] *See, e.g.*, Jonathan B. Baker, "Further Comments on Spectrum Auction Rules That Foster Mobile Wireless Competition," attached to *Ex Parte* Presentation of T-Mobile USA, Inc., GN Docket No. 12-268 & WT Docket No. 12-269 (Aug. 2, 2013); Martin Cave & William Webb, "Spectrum Limits and Auction Revenue: the European Experience," attached to *Ex Parte* Presentation of Sprint Corporation, GN Docket No. 12-268 & WT Docket No. 12-269 (July 29, 2013); Jonathan B. Baker, "FCC Spectrum Allocation Rules That Promote Competition are in the Public Interest," attached to *Ex Parte* Presentation of Sprint Corporation, GN Docket No. 12-268 & WT Docket No. 12-269 (July 8, 2013);

The DMR can be used if the Commission adopts a competition policy requiring implementation of spectrum-aggregation limits subject to a minimum revenue requirement in the upcoming broadcast incentive auction. The DMR allows the Commission to run the forward auction for a given level of spectrum reallocated from broadcast television to mobile broadband and see if the clearing rule is satisfied.[6] If not, the Commission would gradually relax the spectrum limits to the extent necessary until all such spectrum-aggregation constraints are removed from the auction.[7]

Revenue

AT&T's first concern with the DMR is that it might cause revenue shortfalls.[8] To support this assertion, AT&T develops a simple example. While we are not currently in a position to speculate on "likely" valuations of the bidders and concomitant bidding strategies, we can illustrate the benefits of the DMR using AT&T's example and show how a very small change in the AT&T example demonstrates exactly how the DMR can increase revenue compared to an auction with no spectrum-aggregation limits.

In particular, AT&T presents a simple example of a market with seven licenses available and eight bidders interested in acquiring spectrum.[9] We use the same number of licenses, the same number of bidders and the same valuations with one small change: the valuation of bidder six is 4, not 3. A very minor change to what are already arbitrary bidder valuations produces greater revenue with limits than an auction with no spectrum-aggregation limits.

We look first at the difference between an auction with strict spectrum-aggregation limits and one in which there are no limits and some bidders with little chance of winning decline to participate in the auction because they realize they would be unlikely to win a license. The following graph compares revenues in these two scenarios.

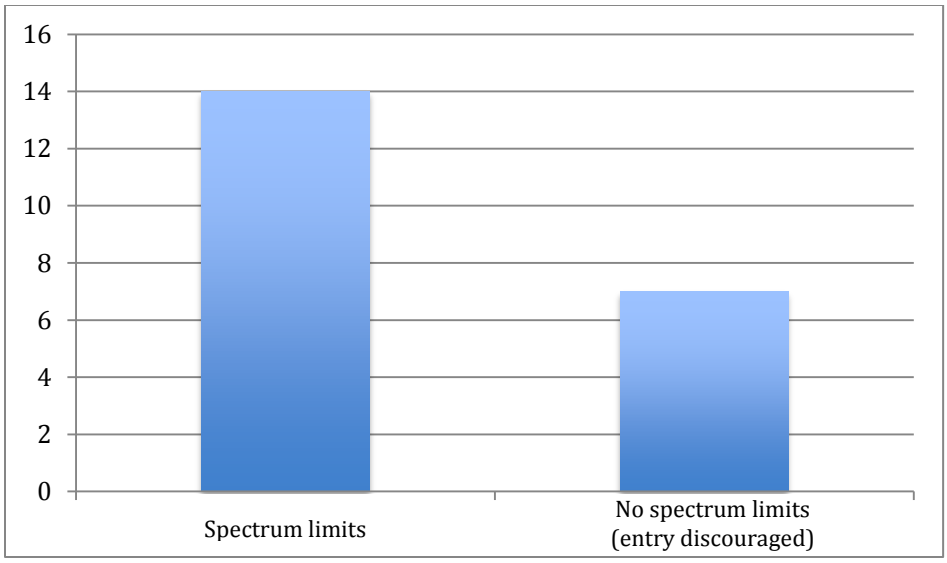
Peter Cramton, *The Rationale for Spectrum Limits and Their Impact on Auction Outcomes* (Sept. 9, 2013) attached to *Ex Parte* Notice of T-Mobile USA, Inc., GN Docket No. 12-268 & WT Docket No. 12-269 (Sept. 9, 2013).

[6] *See* T-Mobile Proposal at 1-2.

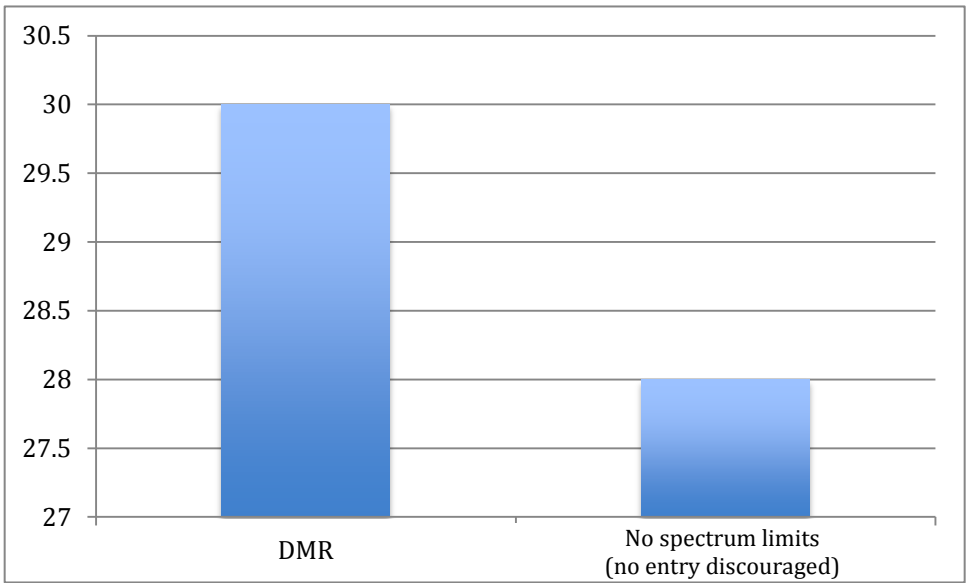
[7] *Id.*

[8] *See* AT&T Comments at 4.

[9] *See* AT&T Comments at 7.



In this example, the deterrent effect of a lack of a limit outweighs the additional bidding from other bidders, leading to a reduction in total revenue. If running the auction with spectrum limits did not satisfy the revenue requirement, the DMR provides a safety valve that can increase participation and revenue. Comparing outcomes in an auction with the DMR to an auction with no limits shows that the DMR would lead to strictly higher revenue as shown in the chart below.[10]



The revenues in an auction with a DMR are greater than auction revenues with no limits, even in the non-realistic scenario in which imposing the limits would have no beneficial effect on participation and bidding by the bidders with no or little low-

[10] For a more complete explanation of the calculations, see the Appendix below.

frequency spectrum.[11] If some lower value bidders were discouraged from bidding because they perceived no chance of winning without spectrum-aggregation limits or were worried about their exposure problems, the differential revenue from a no-limit auction and the DMR would be even greater.

In summary, this slight modification to AT&T's example shows that it is not correct to claim that using the DMR would necessarily reduce revenues or put spectrum reallocation at risk.[12]

Exposure Risk

AT&T's second major concern is that the DMR might cause AT&T to experience additional exposure risk.[13] Essentially, exposure risk arises when a bidder might have a business plan that requires a package of licenses, but that plan would be substantially less valuable with a subset of the licenses. In this case, AT&T claims that limiting it to one license with the possibility of getting two licenses might cause it to not bid at all (or bid much less aggressively) because it would risk not having the spectrum-aggregation limit relaxed.[14]

First, AT&T's exposure risk concern seems at odds with AT&T's revenue concern. If a spectrum-aggregation limit were "likely" to cause substantial revenue shortfall and cause the forward auction not to meet the clearing rule, then AT&T should not be worried about only being able to acquire one license—under this scenario the DMR the limit would be relaxed and AT&T would able to buy a second license and avoid its claimed exposure problem.

Second, the nature of AT&T's claimed exposure problem should be offset by exposure problems for smaller carriers – allowing AT&T to cover its exposure risk at low cost probably exacerbates the exposure risk for its rivals. For example, without package bidding, a smaller company could easily be frustrated in putting together a sufficiently large footprint because of strategic bidding by the largest carriers. However, with the DMR, the smaller carriers would be protected from such strategic bidding to some extent and be more confident to bid aggressively knowing they had a more reasonable shot at putting together a viable aggregation.[15]

---

[11] This scenario is unlikely because bidders facing a higher chance of winning are more likely to participate in the auction and, if they participate, bid more aggressively because they face a *smaller* exposure problem since they can worry less about carriers with a lot of spectrum bidding up the prices in a few key areas.

[12] The example shows that Verizon is similarly incorrect when it states that the DMR "would result in lower revenues than an unrestricted auction." Verizon *Ex Parte* Notice at 3. The DMR also, obviously, then would not "effectively become a revenue ceiling." Verizon *Ex Parte* Notice at 3.

[13] *See* AT&T Comments at 4-5.

[14] *See* AT&T Comments at 8-9.

[15] In response to exposure risk, bidders might bid less aggressively or not bid at all. *See* Paul Milgrom, PUTTING AUCTION THEORY TO WORK 277-78 (2004).

In thinking about possible exposure risk, it is important to articulate a theory of why a firm might have a higher value for a package of licenses or require a minimum set of licenses. New entrants and smaller providers might require a minimum expected market to efficiently build a brand and infrastructure. In addition, they might require contiguous markets. Larger carriers might have a different issue because they have infrastructure (including infrastructure for low-band spectrum) and brand name. As a result, they may require some minimal population coverage to be willing to invest in the fixed costs to add additional radios for their handsets, but the additional spectrum would have much less effect on stores, advertising location, or even towers. As a result, large carriers would likely have a benefit from getting a minimum amount of coverage, but have a substantially lower exposure risk than smaller carriers.[16]

Assuming that AT&T is right that it would need a minimum of 10x10 MHz of spectrum to efficiently provide service, under T-Mobile's proposed sub 1 GHz spectrum-aggregation limit with the minimum access exception, AT&T would be able to buy at least 10x10 MHz licenses covering at least 100 million pops and 5x5 MHz licenses covering the remainder of the country.[17]

We also would note that the areas where AT&T is most likely to be constrained by a spectrum-aggregation limit on low-band spectrum are exactly the areas where AT&T has the highest amount of low-band spectrum already. As a result, to the extent a constraint on spectrum-aggregation could be said to harm AT&T, the constraint should be *least* harmful in those areas where AT&T needs additional low-band spectrum to construct, expand or enhance its low-band network operations.

Finally, AT&T also claims that the DMR introduces a new exposure problem not present in the original Milgrom, Ausubel, Levin, and Segal proposal ("MALS")[18] in that intra-round bids are processed as package bids in every area and that this cannot be achieved in the DMR.[19] While in our original proposal for particular ways to implement the spirit of DMR we did not discuss intra-round bidding in any great

---

[16] AT&T provides an example where it might be interested in buying *either* Los Angeles *or* New York license. One reason for such a preference could be to foreclose a nation-wide competitor from acquiring a nation-wide footprint in low-frequency spectrum by buying excess spectrum (or simply threatening to bid up the prices) in a subset of major markets.

[17] AT&T has previously argued that the Commission can efficiently review the competitive effects of all acquisitions post-auction. *See* Reply Comments of AT&T Inc., GN Docket No. 12-268, 8-9 (Mar. 12, 2013). From this premise, AT&T should have no objection to spectrum-aggregation limits for auctions because if AT&T's acquisition of spectrum in excess of its auction limit in a region truly had no effect on competition, then AT&T would be able to acquire that spectrum in the post-auction secondary market and receive Commission approval.

[18] Paul Milgrom, Lawrence Ausubel, Jon Levin, & Ilya Segal, Incentive Auction Rules Option and Discussion, Notice of Proposed Rulemaking, App. C (Sept. 12, 2012), *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db1002/FCC-12-118A2.pdf.

[19] AT&T Comments at 9-10.

detail, the FCC could allow the intra-round bids for the 'regular' and 'no-limit' licenses in one area to be treated as package bids so that a bidder could express a desire to reduce demand for licenses in one category if and only if it is allowed to reduce in the other category at the same time. This approach would give bidders the same opportunity to express valuations as in the MALS proposal without the DMR.

Combining DMR with Extended Rounds

One issue that we noted, but did not discuss in our initial filing on the DMR was the integration of the Supplemental Rounds with the MALS2 proposed extended rounds.[20] We believe it is possible to integrate these two concepts in a seamless manner in the auction. Below we provide a description of one such implementation.

1. The forward auction starts with the spectrum-aggregation limits in place and prices continue to rise until there is no excess demand anywhere.

2. At that point revenues are compared to the revenue target. If it has been met or exceeded, the auction is over.

3. If the revenues are short of the target, in any area where there are bidders subject to the aggregation limit bidding at their limit, the price continues to go up until one bidder reduces demand at this price.

4. When that happens, all bidders currently at the spectrum-aggregation limit in that area are asked if they would like to buy the license that just became available.
    a. If no firm expresses demand for that license, the price clock stops in this area and the license (provisionally) goes back to the bidder who reduced demand (and the price stops at the last level where demand = supply). This results in the same allocation as in the end of the regular rounds but at higher prices (as hoped for in the design of extended rounds) and no risk of excess supply.
    b. If exactly one firm expresses demand for the additional license, the clock stops and that bidder is a (provisional) winner of that license.
    c. If more than one firm expresses demand for this license, it is then called the "no-limit" license and the firms demanding it continue bidding for *this one license only* (in each such area) until demand equals supply.

5. After step 4 is completed for all areas, revenues are compared to the clearing target (or, alternatively, they can be compared to the clearing target

[20] *See* T-Mobile Proposal at 4.

continuously). If the clearing rule is satisfied, the forward auction ends. If the clearing rule is not satisfied, the regular price clocks continue to increase in any area where there is at least one bidder subject to the spectrum limit, as in step 4. That is continued until either all limits have been relaxed or the revenue target is reached or exceeded.[21]

6. If the revenue target has not been met even after all limits have been relaxed in step 5 (*i.e.* even if in all areas with at least one bidder at their limit the last time there was excess supply of licenses none of the limited bidders expressed demand for that extra license), the FCC can offer a one-shot offer (or a series of one-shot offers) to the winning bidders to cover the gap between auction revenues and the clearing target as T-Mobile proposed in its initial comments.[22] Alternatively, the FCC could implement at this point the MALS2 extended-rounds proposal.

7. Areas with excess supply at the end of the regular rounds can be relaxed first, before step 4 is applied to all areas.

8. The auction rules would specify activity rules and the opportunities for bidders to substitute demand across areas during these supplementary/extended rounds. We have discussed some alternatives in our previous memo and continue to explore the relative benefits of these and other options.[23]

Running the extended/supplemental rounds this way causes any bidder contemplating reduction of demand during the extended rounds to face a new risk that some of the other bidders (especially one of the limited ones) can take the license at the current clock price. This design still brings about the additional competition among capped firms for the licenses they can get above their spectrum-aggregation limit. Finally, this design creates no excess supply during the supplementary/extended rounds so the revenue in the forward auction would only increase as the rounds progress for each relaxation of the limit.

Conclusion

The DMR allows the Commission to put spectrum-aggregation limits to a market test, potentially increasing auction revenues. AT&T's example, with a minor change to its arbitrary values, demonstrates how the DMR could enhance auction revenue

[21] As in our original proposal there is a question of what to do in step 5 with the price of the no-limit licenses if it were above the regular price in step 4c. We propose to re-set the no-limit price to the regular price at this point to minimize strategic bidding.
[22] Comments of T-Mobile USA, Inc., GN Docket No. 12-268, 56-57 (Jan. 25, 2013).
[23] *See* T-Mobile Proposal at 4, 8.

relative to an auction with no spectrum-aggregation limit. Moreover, the prospect for gradual relaxation of the limits should ensure that limits will not cause the auction to fall short of the clearing target.

AT&T's apparent concern regarding the exposure risk is similarly misplaced. The DMR does not create substantial additional exposure risk; AT&T's concerns are inherent in the MALS incentive auction framework. Moreover, even if the exposure risk AT&T discusses were specific to the DMR, reducing exposure risk for AT&T would increase exposure risk for smaller bidders. Therefore, removing the DMR does not necessarily decrease the net exposure risk, but shifts the risk to smaller carriers. Finally, AT&T's arguments seem logically inconsistent – if the DMR was almost sure to cause a revenue shortfall as AT&T argues, then the limits would be relaxed and AT&T would not face an exposure risk.

Furthermore, it is relatively straightforward to combine the DMR with the MALS2 extended round proposal to further increase the chance that the revenue in the forward auction meets the minimum revenue requirement to satisfy the clearing rule.

In short, the Commission can adopt spectrum-aggregation limits and use the DMR mechanism to enhance auction competition while providing assurances that the limits will be enforced only as long as revenues meet or exceed the required revenue target.

Appendix – Revenue from Alternative Auction Rules

AT&T prepared a table of bidder valuations.[24] Here we change the value for bidder number six from 3 to 4 to illustrate how the DMR can lead to greater revenue than an auction with no spectrum-aggregation limits, and how, if the lack of spectrum-aggregation limits causes bidders not to participate, revenues can be very low. In addition, the example shows that the DMR can increase revenues relative to inflexible limits.

AT&T's example of valuations with bidder 6's value changed from 3 to 4.

Bidder	Valuation for One License	Valuation for Second License
1	7	7
2	7	6
3	6	6
4	5	0
5	4	0
6	4	0
7	2	0
8	1	0

Scenario 1: *Bidders 1 and 2 are constrained to win at most one license and all bidders participate hoping to win the additional two licenses.*

In this scenario bidders 1-6 win, with bidder 3 winning two licenses and all other winners one each. The price is set by the highest losing bidder, bidder 7, at 2 per license.

Total revenue is 7*2 = 14.

Scenario 2: *No constraints on bidding leads bidders 5 and 6 not to bid.*

Smaller bidders may forgo or curtail auction participation if they believe they have little or no chance of winning licenses.[25] For example, knowing that bidders 1-3 can buy 2 licenses each and bidder 4 has a higher valuation than them, bidders 5-7 may decide not to bid in the auction. This scenario would result in price of 1 per license (set by the strongest losing bidder, bidder 8).

---

[24] *See* AT&T Comments at 7.

[25] *See, e.g.*, *Ex Parte* Notice of T-Mobile USA, Inc., GN Docket No. 12-268 & WT Docket No. 12-269 (July 18, 2013); Reply Comments of T-Mobile USA, Inc. GN Docket No. 12-268, iv-v, 44 (Mar. 12, 2013).

Total revenue is 7*1=7.

Scenario 3: *The auction uses the DMR, all bidders participate and the revenue target is more than 14 (and less than 30).*

In this case the auction would continue from the point we analyzed in Scenario 2. One license would be moved to the "no-limit" category and at price 2 bidders 1 and 2 would express demand for an additional license. Both prices would go up. The regular price clock would stop at price 4, when bidders 6 would drop out. The "no-limit" price would then continue till 6, when bidder 2 would reduce demand for the second license.

Total revenue is 6*4 + 6 = 30.

Scenario 4: *No limits and, unlike Scenario 1, there is no impact on bidder participation.*

This is the scenario analyzed first by AT&T – as they point out, the price would be set by bidder 5 at 4.[26]

Total revenue is 7*4 = 28.

[26] AT&T Comments at 7.